ASTRONOMICAL SOCIETY OF LONDON.

November 12, 1830. No. 30.

THE following communications were read: —

I. Ephemeris of the occultations of α Tauri in 1831, for ten European Observatories, by Mr. Maclear.

This list of occultations has been computed to within 5^s, and then verified by another process.

In addition to the sidereal and mean solar time of the immersion and emersion of the star, the author has determined the place on the moon's limb where the phenomenon takes place, by reference to the *vertical* point, and also to the *northern* point of her disc. The latter mode he conceives is most convenient, where the telescope is mounted equatorially.

The present list is peculiarly favourable for general observation, as in several cases the occultation happens when the moon is near her transit.

II. Practical rules for the approximate prediction of occultations, by Mr. Henderson.

Instead of computing the parallax of the moon by the trigonometrical tables, Mr. H. obtains them with sufficient accuracy from the traverse table contained in the *Nautical Tables of Mendoza Rios, second edition*, 1809; and the proportions, in which 60^m is always one of the terms, are worked by means of *Taylor's Sexagesimal Table*. The results may generally be taken out by inspection, and in every case the interpolation is very easy.

The practical rules are made to apply to three cases, 1st, when the elements are given as in *Encke's Ephemeris;* 2dly, with the *Nautical Almanac* elements; and, 3dly, when the computer has only a catalogue and an ephemeris of the moon. An example of the computation is given in the first two cases, and Mr. H. states that the time employed upon each was about fourteen minutes.

III. A note by Mr. Gompertz, to a paper by M. Kreil on the rectification of the equatorial.

As M. Kriel's paper contains only the formulæ for the problem, without any demonstration, Mr. Gompertz has investigated them, and shewn their accuracy. He has also noticed some other possible causes of error, as, if the horary circle be not fixed at right angles to the polar axis, — if there be any eccentricity in the divided circles, &c.; and shewn the *nature* and *order* of the corrections which would be thereby required.

IV. Occultations observed at Boston, Massachusetts, by Mr. Robert Treat Paine.

Mr. Paine gives the mean solar time of six complete observations of Aldebaran (immersion and emersion), five at Boston and one at Nantucky, with a $3\frac{1}{2}$ feet achromatic telescope, and a magnifying power of 60: the telescope was adjusted on a star. "In four of the observations nothing remarkable was noticed, except that when the immersion or emersion took place on the enlightened limb, the star became so tremulous as to cause an uncertainty of 1^s or 2^s; but in two other instances (one at emersion and the other at immersion) the star did actually appear projected upon the face of the moon for about 2^s; and the light of the star was in both instances very much more brilliant than usual, although the emersion took place about sunset, and the immersion while the sun was above the horizon."

"On September 17, 1829, about 10^s before immersion, the star spread out, and appeared like a star viewed through a telescope not adjusted to distinct vision, and then faded away so gradually that its final disappearance could not be noted with greater precision than 3^s or 4^s. The same appearance was seen by another gentleman observing at a place $2\frac{1}{2}$ miles distant from me."

V. Observations upon the period of the variable star β Lyræ, by Mr. W. R. Birt.

In the year 1784, Mr. Goodricke remarked that β Lyræ varied from the third to the fifth magnitude, and fixed the period of this variation at $6^d\ 9^h$. On the 22d May, 1830, Mr. Birt commenced a series of observations upon this star, and at 11 hours found it of the fifth magnitude, and equal to ε and ζ Lyræ. Supposing the period to be that assigned by Mr. Goodricke, eight revolutions would have been performed in fifty-one days exactly; but when viewed by Mr. Birt on the 12th of July, at 10 o'clock, it was about 3·4 magnitude, and less than γ Lyræ; while on the 13th it was decidedly of the fourth magnitude, and on the 14th of the third, or as bright as γ. Mr. Birt, therefore, concluded, that it came to its minimum brightness between the 12th and 13th, and that the period was therefore longer than that assigned to it by Mr. Goodricke. This conclusion was confirmed by an observation on the 2d of September, when at 11 o'clock the star was exactly equal to ε and ζ, as on the 22d of May, thus giving 103 days for sixteen revolutions, or a period of $6^d\ 10^h\ 40^m$, instead of 102 days, which would have been required if the period were $6^d\ 9^h$. It would seem that the duration of its maximum, as well as of its minimum brightness, is somewhat irregular. Mr. B. gives several comparisons of the star with γ, ε, and ζ Lyræ, from May 22 to September 15.

VI. A paper on terrestrial refraction, by the late Mr. Henry Atkinson.

On the fluctuations of the atmosphere near the earth's surface; and

On the effect of such fluctuations upon the refraction at the horizon, and at very low altitudes, especially on the dip of the horizon at sea.

(*Unfortunately, these papers are unfinished: the ingenious author did not live to complete them.*)

In these investigations Mr. A. proposed to himself to demonstrate,

1st, That the fluctuations in the state of the atmosphere near the surface of the earth are not only fully adequate to account for the very great variations which have been observed in the horizontal refraction, but even for still greater variations.

2dly, That the variations of the dip of the horizon at sea are caused by the fluctuations of the atmosphere, and can be calculated when the latter are known.

The extreme uncertainty of the law of the variation of temperature near the earth's surface has been remarked by every observer who has directed his inquiries to this subject, by a proper adaptation of course and distance to the circumstances of the problem.

We find well-recorded cases where small alterations of elevation have produced very sensible effects upon the air, sometimes increasing and sometimes diminishing its temperature; and, again, at other times, we find the temperature of the air nearly the same through very considerable altitudes. (See *Wells*, *Humboldt*, &c.)

In order to subject to calculation the different hypotheses which may be imagined, Mr. A. supposes that the variations of temperature may be actually observed within certain limits of altitude (he has here assumed fifty feet); and that the state of the atmosphere at great elevations, for example at 1125 feet above the surface of the earth, may be considered to be in a *mean state*. Considering the state of these upper and lower portions of the atmosphere to remain unchanged, he calculates the change in the whole horizontal refraction which would be produced by two arbitrary and very dissimilar suppositions as to the distribution of temperature in the intermediate portion of 1075 feet, and draws the conclusion, that the variation of refraction arising from any conceivable derangement in this middle portion will be inconsiderable, compared with that which may be produced by changes in the lowest portion.

In considering the problem of the dip of the horizon, Mr. A. first obtains an expression for it where there is no terrestrial refraction, and deduces this simple approximate formula, that the dip in seconds $= 63'',82 \times \sqrt{h}$, where h is the altitude in *feet* above the level of the sea.

But when account is to be taken of the terrestrial refraction, Mr. A. finds, that if the included arc of the earth's surface be to the terrestrial refraction as $n : 1$ (and this is to be determined from a table of terrestrial refraction according to the then existing state of the atmosphere), the preceding expression is thus modified. The

$$\text{dip in seconds} = 63'',82 \times \sqrt{\frac{n-2}{n}} \times \sqrt{h}.$$

J. MOYES, TOOK'S COURT, CHANCERY LANE.